

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No.: 09/980,496

REMARKS

Claims 1-7 are all the claims pending in the application. Claims 1 and 4 are amended for editorial purposes only without narrowing the scope of the claims. Entry of the amendment is respectfully requested along with reconsideration and review of the claims on the merits.

Preliminary Items

Applicants appreciate that the Examiner has acknowledged receipt of the certified copies of the priority documents from the International Bureau.

Also, Applicants appreciate that the Examiner has returned initialed copies of two PTO-1449 forms previously filed.

Objection to the Specification

In paragraph 1, the Examiner objects to the title of the invention as not descriptive and requires a more descriptive title.

Applicants respond by amending the title to "Battery Separator Containing Carbodiimide Polymer". Entry of the amendment is respectfully requested along with reconsideration and withdrawal of the objection to the title.

Allowable Subject Matter

Applicants appreciate that the Examiner has stated that claims 6 and 7 stand objected to as being dependent upon a rejected base claim, but would be allowable if written in independent form.

Prior Art Rejections

Claims 1 and 3-5 stand rejected under 35 USC 103(a) as allegedly being unpatentable over Otani et al in view of Amano et al, and further in view of Nakamura et al for the reasons given in the Office Action.

Otani is cited as teaching a battery separator made of a polyethylene porous sheet. The Examiner admits that Otani does not teach the application of a polymer having repeating carbodiimide groups on the porous sheet.

Amano is cited as teaching the use of a pulp-like material which includes polycarbodiimide as a coating. The Examiner then argues that the material of Amano can be made into a sheet with excellent properties, including electrical insulation, heat resistance, flame resistance and mechanical properties, and is stated to be suitably used as a battery separator.

The Examiner concludes that it would have been obvious to one of ordinary skill in the art to apply a polycarbodiimide on the battery separator of Otani, because Amano teaches that polycarbodiimide has excellent electrical, thermal and mechanical properties.

Nakamura is cited as teaching a process for producing polyfunctional polycarbodiimide compounds. The molecular weight of the resulting compounds are about 1,000 to 30,000. The Examiner relies on this disclosure as allegedly suggesting the number of repeating units of the carbodiimide contained in the polymer of Applicant's claim 1.

Applicants traverse the rejection.

The prior art does not suggest applying a polymer having repeating carbodiimide units as claimed to a porous sheet substrate, much less suggest the unexpected superior advantages

described in the present application. In particular, the unexpected superior results in the specification (see Table 1) demonstrate that when porous sheets formed from polycarbodiimide-coated polymer particles having polycarbodiimide structural units are used as battery separators, then the self-discharge of the cells is considerably inhibited.

As discussed in detail below, one of ordinary skill in the art would not have combined the disclosure of Amano or Nakamura with Otani. Thus, at a minimum, the Examiner's rejection is based on an impermissible "hindsight" reconstruction.

Otani may teach a battery separator made of an ultrahigh molecular weight polyethylene porous sheet, but Otani does not teach the application of a polymer having carbodiimide groups on the porous sheet.

Amano teaches a pulp-like composite material wherein an inorganic material other than asbestos is covered with a polycarbodiimide (see Abstract). This pulp-like composite material has excellent electrical insulation, heat resistance, flame resistance, mechanical properties, and the like, and further has good miscibility with other components in the field of friction material, etc., and can be used as a substitute of asbestos (column 2, lines 35-40).

However, Amano does not contain any disclosure to teach or suggest that a polycarbodiimide has a self-discharge inhibition of a cell, and that a polycarbodiimide is applied to a battery separator comprising a porous sheet. Therefore, one skilled in the art would not be motivated to combine Amano with Otani.

Nakamura may teach a process to produce a polyfunctional polycarbodiimide containing at least four molecular chains bonded independently to a backbone. However, Nakamura also

does not contain any disclosure to teach or suggest that the polycarbodiimide is applied to a porous sheet that is a battery separator, and by such an application, such a battery separator exhibits an improved self-discharge inhibition. Therefore, one skilled in the art would not be motivated to also combine Nakamura with Otani.

On the other hand, the present invention provides a battery separator wherein a polycarbodiimide is applied to a porous sheet substrate. When such a battery separator is used in a cell, it exhibits a self-discharge inhibition.

Regarding Claims 3-5, the same arguments for traversal on the merits are applicable to overcoming the rejection of these claims. As mentioned in the rejection of claim 1 above, one skilled in the art is not motivated to apply the teaching of Amano and Nakamura to a battery separator comprising an ultrahigh molecular weight polyethylene porous sheet. Therefore, Applicants submit that Claims 3-5 are also not obvious over the cited art.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a).

Claims 1 and 2 stand rejected under 35 USC § 103(a) as allegedly being unpatentable over Kung in view of Amano and further in view of Nakamura for the reasons given in the Office Action.

With respect to Claim 1, Kung is applied as teaching a battery separator formed of a microporous plastic sheet coated with a resin; the sheet is made of a non-woven fabric selected from the group consisting of polyolefin, polyamides and nylon fibers. However, as with Otani,

the Examiner admits in the sentence bridging pages 3 and 4 of the Office Action comments, that Kung does not teach the application of a polymer having carbodiimide onto the porous sheet.

Amano and Nakamura are applied in the same fashion as set forth in the Otani-based rejection.

Applicants traverse the rejection.

With respect to independent Claim 1, one of ordinary skill in the art would not have been motivated to use Amano's composite material or Nakamura's material on the sheet of Kung. Certainly, there is no express disclosure suggesting the claimed structure or that the particular advantages attained in the present invention would be obtained. Kung merely discloses resin coating in order to increase wettability of a porous separator used in a wettable separator.

As mentioned above, Amano and Nakamura do not contain any disclosure to teach or suggest a self-discharge inhibition of a battery due to polycarbodiimide. Therefore, one skilled in the art would not be motivated to apply the disclosure of Amano and Nakamura to Kung.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a).

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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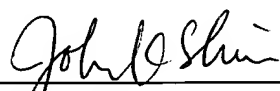
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